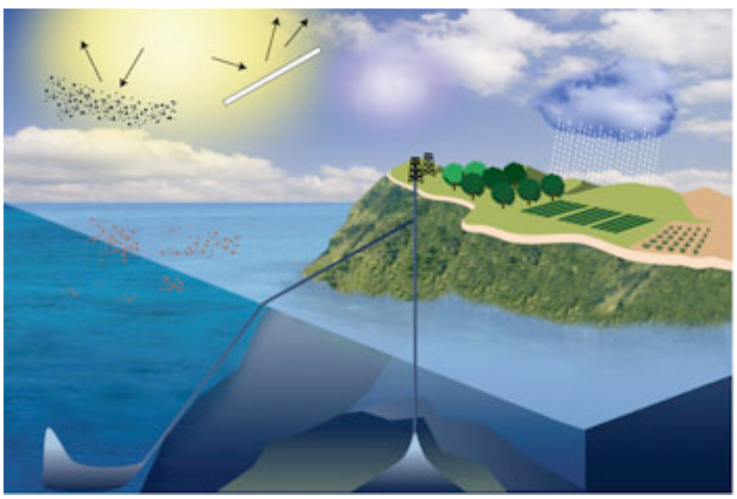
LAWRENCE LIVERMORE
REPORT

A weekly collection of scientific and technological achievements from Lawrence Livermore National Laboratory: May 26-June 2, 2008.

Geoengineering could slow down the global water cycle



A schematic representation of various geoengineering and carbon storage proposals.

As fossil fuel emissions continue to climb, finding ways to reduce the amount of sunlight hitting the Earth could have a cooling effect on surface temperatures.

However, a new study from Lawrence Livermore National Laboratory, led by atmospheric scientist Govindasamy Bala, shows that this intentional manipulation of solar radiation could lead to a less intense global water cycle. Decreasing surface temperatures through "geoengineering" also could mean less rainfall.

In a new climate modeling study, which appears in the May 27-30 online edition of the *Proceedings of the National Academy of Sciences,* Bala and colleagues Karl Taylor and Philip Duffy demonstrate how geoengineering could lead to a decline in the intensity of the water cycle.

For more, see https://publicaffairs.llnl.gov/news/news_releases/2008/NR-08-05-04.html

Science community pays tribute to Teller's legacy

Edward Teller

Nearly 200 people gathered last week at the Bankhead Theater in downtown Livermore for the Teller Centennial Symposium to celebrate the 100th anniversary of Edward Teller's birth and his scientific legacy. The symposium attracted a wide range of attendees, from physicists at the Laboratory and elsewhere to colleagues of Teller to aficionados of the history of science.

Teller, a world-renowned physicist, co-founder of Lawrence Livermore National Laboratory, and lifelong advocate for education, died in 2003 at the age of 95

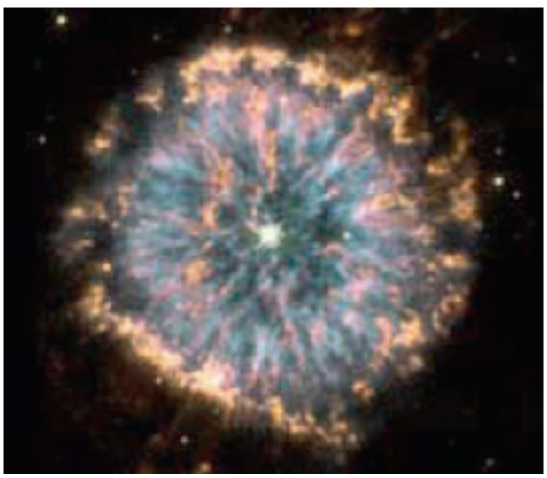
All of the speakers had a connection to Teller, some personal and others through their field of research.

In his welcoming address, Lab Director George Miller observed that Teller "had an enormous impact on physics in the 20th century and was an inspiration to countless researchers at the Laboratory and elsewhere.

“Those of us who were privileged to work with him gained from his vast knowledge, his creativity and insights and his enthusiasm for scientific discovery and its application,” Miller said. “He had an amazing way of always getting to the heart of a matter.”

For more on the symposium, including a video on Teller's life, see https://newsline.llnl.gov/articles/2008/may/05.30.08_teller.php

Stellar serendipity and the carbon conundrum



During their evolution, low-mass stars enrich the interstellar medium with elements, creating a planetary nebula such as the one shown here. (Image courtesy of the Space Telescope Science Institute.)

Using a three-dimensional model run on some of the fastest computers in the world, Lawrence Livermore astrophysicists have cracked a mystery of stellar evolution that has puzzled the astronomical community for nearly four decades. For years, physicists and astronomers theorized that low-mass stars (one to two times the mass of our sun) produce great amounts of the helium-3 isotope. According to this theory, as these stars evolve, they eventually exhaust the hydrogen in their cores before violently igniting their helium-rich cores in a "helium flash."

That process, carried out by billions of stars over billions of years, should have resulted in an interstellar medium enriched with the light helium-3 isotope, adding to the helium-3 created during the Big Bang. Accepted calculations indicate that the Big Bang produced mostly hydrogen, mixed with about 0.001 percent helium-3 and 4 percent helium-4. Later, low-mass stars should have increased the helium-3 amount in the interstellar medium to 0.1 percent.

But observations show that it remains at 0.001 percent, raising the question of where is the missing helium-3?

Using a Livermore-developed 3D astrophysics code, Laboratory scientists Peter Eggleton and David Dearborn uncovered a mixing mechanism that not only accounts for the mysteriously missing helium-3, but also could explain an equally mysterious overabundance of carbon-13.

For more, see https://www.llnl.gov/str/MayJune08/eggleton.html

More milestones for the National Ignition Facility

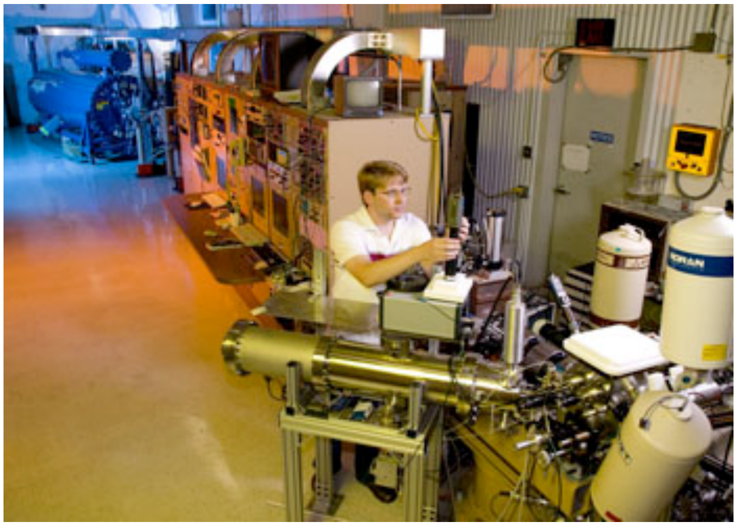
Technicians installing a transport mirror on NIF's 5,000th LRU

Two significant project milestones for the National Ignition Facility (NIF) were reached this week. NIF is Lawrence Livermore’s 192-beam laser that will be used to conduct fusion experimentation starting in 2010. Earlier this week, the 5,000th production line replaceable unit (LRU) was installed. LRUs are modules that contain laser optics or mechanical units necessary for NIF operation. LRU installation is now more than 80 percent complete, with more than 1,200 LRUs remaining.

Also, the 48th integrated optics module (IOM) was installed, marking the completion of installation of the first bundle of 48 beams on the target chamber. The overall project is now 97 percent complete, with the capability of delivering up to 3.42 megajoules of infrared laser energy.

In other NIF news, Christoph Niemann, who holds the NIF Professorship in High Energy Density Science at UCLA, has been awarded the DOE Plasma Physics Junior Faculty Award to fund his research on K-alpha sources for three years. In addition, two of Niemann's papers have recently been accepted for publication in *Applied Physics Letters.*

Photo of the week



Accelerating research: Laboratory researcher Scott Tumey prepares an experiment at the Lab's Center for Accelerator Mass Spectrometry. CAMS is home to the most versatile and productive accelerator mass spectrometry (AMS) facility in the world. AMS is an exceptionally sensitive technique for measuring concentrations of isotopes in small samples, typically less than 1 milligram, and the relative abundance of isotopes at low levels. It can, for example, find one carbon-14 isotope among a quadrillion other carbon atoms. Mass spectrometry has been used since early in the 1900s to study the chemical makeup of substances. A sample is put into a mass spectrometer, which ionizes it and analyzes the motion of the various ions in an electric field to sort them out by their mass-to-charge ratios.

----

and industry to bring the full weight of the nation’s science and technology community to bear on solving problems of national importance.

To send input to the Livermore Lab Report, send e-mail mailto:labreport@llnl.gov.

The Livermore Report archive, including today’s issue, is available at: https://publicaffairs.llnl.gov/news/lab_report/2008index.html